

ACTUATING DEVICE WITH SENSOR FOR CONTROLLING MOVEMENT OF
GATES"

The present invention relates to a device and an actuator for
5 moving gates.

In the prior art hydraulic actuators for gates are known
comprising two opposite actuating cylinders that are
axially aligned and oppositely protruding from a central
body that is provided with an output pinion that is
10 controlled by the cylinders. These types of actuators are
in general intended to be buried in a suitable recess at a
hinging of the gate to be moved so that the power output
can connect suitably to the gate.

Such actuators are completed with an electric pump that
15 provides pressurized fluid upon command from a control
device reached by the opening and closing commands of the
gate.

In order to identify and maintain the arrest points or
deceleration ramp start, auxiliary devices are generally
20 used, such as electric switches suitably arranged for being
actuated by the passage of the gate or of some movement-
transmitting element. This makes it necessary to position
and adjust such auxiliary elements correctly. Further, safety
against crushing is often required that enables slowing or
25 jamming of the gate to be detected and stops the movement
thereof. This entails introducing other auxiliary devices
that are not easy to position and manage.

Everything has to be completely reliable and must therefore
be affected as little as possible by play in the drive or

by factors external to the drive.

It is also desired that in the event of malfunction of the auxiliary detecting devices they should be replaced rapidly and easily, further minimizing the operations for adjusting
5 the new device. The solutions provided by the prior art do not entirely meet these needs.

The general object of the present invention is to remedy the aforesaid drawbacks by providing a gate-movement actuating device that enables precise detection and control
10 of the movement of the gate to be achieved without the need for auxiliary devices.

In view of this object it was decided to make, according to the invention, a device for moving a gate comprising an actuator comprising in turn two opposite actuating
15 cylinders that are axially aligned and protruding oppositely from a central body that is provided with an output pinion commanded by the cylinders, characterized in that with the pinion there is associated a detecting encoder for detecting pinion movement.

20 In order to make the explanation of the innovative principles of the present invention and the advantages thereof over the prior art clearer, with the help of the attached drawings a possible embodiment applying such principles will be disclosed below by way of example. In
25 the drawings:

- figure 1 is a schematic perspective view of an actuator made according to the principles of the present invention;
- figure 2 is an exploded partial view of a detail of the actuator in figure 1;

- figure 3 is a schematic view of a device according to the invention and comprising the actuator in figure 1.

With reference to the figures, in figure 1 there is shown a hydraulic actuator for gates, indicated generally with 10, which comprises two opposite actuating cylinders 11, 12 that are axially aligned and oppositely protruding from a central body 13. From the central body 13 an output pinion 14 protrudes above that is rotated in both directions by hydraulic cylinders, according to a mechanism, in general a rack mechanism, which is not further shown or disclosed here, as it is well known and easily imaginable by those skilled in the art. The actuator is generally intended to be buried in a suitable recess to have the pinion connected suitably to the gate to be moved.

An encoder 15 is associated with the pinion, which encoder 15 directly detects pinion movement to emit position signals through an electric cable 16.

In figure 2 there is shown an exploded view of the zone of the encoder around the pinion. As can be seen in the figure, the pinion traverses a closing cover 17 of the seat thereof in the body 13 and in which the pinion ends with the connection to the kinematic movement commanded by the two cylinders. In the case in point, the pinion has, for example, a gear 18 connecting to a rack, which is not shown, moved by the hydraulic cylinders.

In the embodiment shown, the encoder comprises a disc 19 splined on the pinion by means of teeth 20 that make the disc 19 integral therewith during rotation. The disc is received in a suitable shell 21, tightened on the cover 17

and in turn closed above by a cover 22. The encoder comprises sensor means 23 for detecting the rotation of the disc 19. The nature of the sensor means will depend on the technology used for detecting the rotation of the disc 19.

5 In the preferred embodiment, the encoder is of the magnetic type, as the disc is suitably magnetized and the sensor means are detecting means for detecting variations in the magnetic field produced by the rotation of the disc.

The disc may have a periphery provided with radial teeth 24
10 the passage of which has been detected by the sensor means. In the case of a magnetic sensor the teeth are magnetized. Alternatively, the periphery of the disc may be smooth or be otherwise shaped.

The sensor means are advantageously such as to make an
15 incremental encoder that can detect not only the amount of the pinion movement but also the movement direction, as easily imaginable by those skilled in the art.

As well illustrated in figure 2, the shell 21 has an outer coupling seat 25 laterally for removably coupling the
20 sensor means, which are advantageously housed within a plug-shaped enclosure 26, near the head end thereof, to face one another at the periphery of the disc when the head of the enclosure 26 is coupled with the seat 25.

In order to maintain the plug 26 in position in the seat,
25 between the plug and seat there is the mutual locking means that is snappably removable. Advantageously, such locking means comprises an elastic tongue 27 that couples with a corresponding tooth 28. The tooth can be the first on the enclosure and the tongue can be on the seat or vice versa.

In the event of a sensor fault removing and replacing the sensor is thus fast and easy.

In figure 3 the device, indicated generally with 30, for moving a gate, comprising the actuator 10 is shown schematically. The device comprises a hydraulic pump 31 with an electric driving motor 32 and which supplies said actuating cylinders 11, 12 with fluid. This occurs with a *per se* known hydraulic circuit 36, provided with suitable one-way valves and check valves so that depending on the motor rotation direction one cylinder is supplied and the other is discharged or vice versa. The fluid is taken from a suitable tank 33.

The pump motor is electrically commanded by an electronic control device 34 that receives position information from the encoder and other command information 35 (opening/closing, arrest, etc). The control device can advantageously be a system with a suitably programmed microcontroller. It has been found to be advantageous for the pump motor to be a direct-current motor (for example a 24 VDC motor) that is commanded through feedback by the control device on the basis of the position information received by the encoder. Owing to this, the gate can be commanded with precise and advantageous acceleration and deceleration ramps. The direct-current motor can operate at higher rotation speeds than alternating current motor/pump units so that the incidence of loss of volumetric load compared with total efficiency is reduced.

Further, owing to the encoder, end and intermediate arrest points can be set easily without the need for mechanical

calibrations. In the event of obstacles to movement, the control device 34 can immediately detect the fault condition, as the position information supplied by the encoder shows directly without error the slowing or the sudden stop of the pinion.

At this point it is clear how the preset objects have been reached.

The encoder applied directly to the outlet axis of the automation enables the angular movement of automation to be managed with precision by managing the arrest or deceleration start points and the anti-crushing safety functions.

The encoder in fact enables the arrest point or start of the deceleration ramp to be identified and maintained with precision and repeatability without the assistance of auxiliary devices. Further, with the feedback provided the performing of the angular movement of the automation is more accurate. The reading precision of the encoder applied directly to the outlet axis is not affected by errors or intermediate clearance in the kinematics, favoring precision and compliance with safety standards.

There is also great simplicity of use and facility of installation, maintenance and repair. The encoder can be administered by software that automatically manages both the initial setting (for example with self-learning) and maintaining the settings. The quick-connector conformation enables the encoder to be replaced or repaired very fast, without the help of tools.

Owing to the principles of the invention, there is great

flexibility of automation driving. The simple and cheap control of the direct-current motor (which can be easily achieved by modulating the supply voltage) with feedback of the encoder enables the most suitable hydraulic pressure
5 for requirements to be obtained whatever the dimensions and weight of the gate.

As a result, there is also the possibility of optimal management of the gate start-up/deceleration transients, and greater rapidity of installation inasmuch as the system
10 calibrating step is more immediate to conform to the impact curves prescribed, for example, by industry safety standards.

Naturally, the description given above of an embodiment applying the innovative principles of the present invention
15 is provided only by way of example of such innovative principles and must not therefore be taken to limit the scope of what is claimed herein. For example, although in the preferred embodiment the encoder is of magnetic type, as it is not sensitive to dirt, an encoder of optical type
20 can be used and the disc 19 can thus be made as a phonic wheel or the like, with the sensor means formed by photodiodes and phototransistors or equivalent components, as easily imaginable by those skilled in the art.

CLAIMS

1. Device for moving a gate comprising an actuator (10) comprising in turn two opposite actuating cylinders (11, 12) that are axially aligned and oppositely protruding from a central body (13) that is provided with an output pinion (14) controlled by the cylinders, characterized in that with the pinion there is associated a detecting encoder (15) for detecting pinion movement.
2. Device according to claim 1, characterized in that the encoder comprises a disc (19) splined on the pinion and sensor means (23) for detecting the rotation of the disc.
3. Device according to claim 2, characterized in that the disc (19) is received in a shell (21) surrounding the base of the protruding pinion, the shell having laterally a removable outer coupling seat (25) of the sensor means.
4. Device according to claim 3, characterized in that the sensor means (23) are contained in a plug-shaped enclosure (26) with the sensor means arranged at a head end thereof to face one another at the periphery of the disc when the head of the enclosure is coupled in said seat (25).
5. Device according to claim 4, characterized in that between the enclosure and the seat there is mutual locking means (27, 28) that is snappably removable.
6. Device according to claim 5, characterized in that the removable locking means comprises an elastic tongue (27) on the seat or on the enclosure and which couples with a corresponding tooth (28) on the enclosure or on the seat.
7. Device according to claim 2, characterized in that the

disc has the periphery provided with radial teeth (24) the passage of which has been detected by the sensor means (23).

8. Device according to claim 2, characterized in that the encoder is of the magnetic type and comprises the magnetized disc and the sensor means that are suitable for
5 detecting the corresponding variation in magnetic field produced by the rotation of the disc.

9. Device according to claim 1, characterized in that it comprises a hydraulic pump (31) with an electric driving
10 motor (32) and which supplies said actuating cylinders with fluid, the pump motor being electrically commanded in both directions by an electronic control device (34) that receives position information from the encoder (15).

10. Device according to claim 9, characterized in that the
15 pump motor is a direct-current motor commanded through feedback by the control device (34) on the basis of the position information emitted by the encoder (15).